

CLAIMS

1. A tin-containing plating bath comprising:
  - (a) a soluble stannous salt, or  
5 a mixture of a soluble stannous salt and at least one soluble salt selected from the group consisting of copper salts, bismuth salts, silver salts, indium salts, zinc salts, nickel salts, cobalt salts and antimony salts; and
  - 10 (b) at least one aliphatic sulfonic acid selected from the group consisting of alkanesulfonic acids and alkanolsulfonic acids,  
the aliphatic sulfonic acid being a purified aliphatic sulfonic acid in which the total amount of a sulfur-  
15 containing compound or compounds having one or more sulfur atoms with an oxidation number of +4 or less in the molecule and a sulfur-containing compound or compounds having one or more sulfur atoms and one or more chlorine atoms in the molecule is a minute amount  
20 or less.
2. The tin-containing plating bath according to claim 1 wherein the compound having sulfur atoms with an oxidation number of +4 or less in the molecule is dimethyldisulfide, and whose content  
25 in the plating bath is less than 200 ppm.
3. The tin-containing plating bath according to claim 1 wherein the compound having a sulfur atom with an oxidation number of +4 or less in the molecule is S-methyl methanethiosulfonate, and  
30 whose content in the plating bath is less than 4 ppm.
4. The tin-containing plating bath according to claim 1 wherein the compound having a sulfur atom and a chlorine atom in the molecule is  $\alpha$ -chlorodimethylsulfone, and whose content in the  
35 plating bath is less than 4 ppm.

5. The tin-containing plating bath according to claim 1 wherein the compound having sulfur atoms and chlorine atoms in the molecules is  $\alpha$ -methylsulfonyl- $\alpha,\alpha$ -dichlorodimethylsulfone, and  
5 whose content in the plating bath is less than 4 ppm.

6. The tin-containing plating bath according to claim 1 wherein the compounds having one or more sulfur atoms with an oxidation number of +4 or less in the molecule are dimethyldisulfide and S-  
10 methyl methanethiosulfonate, and the compounds having one or more sulfur atoms and one or more chlorine atoms in the molecule are  $\alpha$ -chlorodimethylsulfone and  $\alpha$ -methylsulfonyl- $\alpha,\alpha$ -dichlorodimethylsulfone;

at least two sulfur-containing compounds selected from the  
15 group consisting of dimethyldisulfide, S-methyl methanethiosulfonate,  $\alpha$ -chlorodimethylsulfone and  $\alpha$ -methylsulfonyl- $\alpha,\alpha$ -dichlorodimethylsulfone are present in the plating bath; and

the total content of the sulfur-containing compounds in the  
20 plating bath is less than 2 ppm.

7. The tin-containing plating bath according to claim 1 wherein the purified aliphatic sulfonic acid is one obtained by purifying an aliphatic sulfonic acid which has been produced by subjecting  
25 alkyl mercaptan or dialkyldisulfide to wet oxidation or by hydrolyzing an alkylsulfonyl halide.

8. The tin-containing plating bath according to claim 1 wherein the purified aliphatic sulfonic acid is one obtained by  
30 subjecting an aliphatic sulfonic acid to concentration under reduced pressure while heating.

9. The tin-containing plating bath according to claim 1 wherein the purified aliphatic sulfonic acid is one obtained by

subjecting an aliphatic sulfonic acid to solid phase extraction in which the aliphatic sulfonic acid is brought into contact with an adsorbent.

- 5    10. The tin-containing plating bath according to claim 9 wherein the purified aliphatic sulfonic acid is one obtained by subjecting an aliphatic sulfonic acid to solid phase extraction at least twice, using the same or different kinds of adsorbents.
- 10   11. The tin-containing plating bath according to claim 1 wherein the purified aliphatic sulfonic acid is one obtained by subjecting an aliphatic sulfonic acid to a combination of concentration under reduced pressure and solid phase extraction.
- 15   12. The tin-containing plating bath according to claim 1 wherein the alkanesulfonic acid is methanesulfonic acid.
13. A bump-forming method comprising forming a bump with the use of the plating bath of claim 1.